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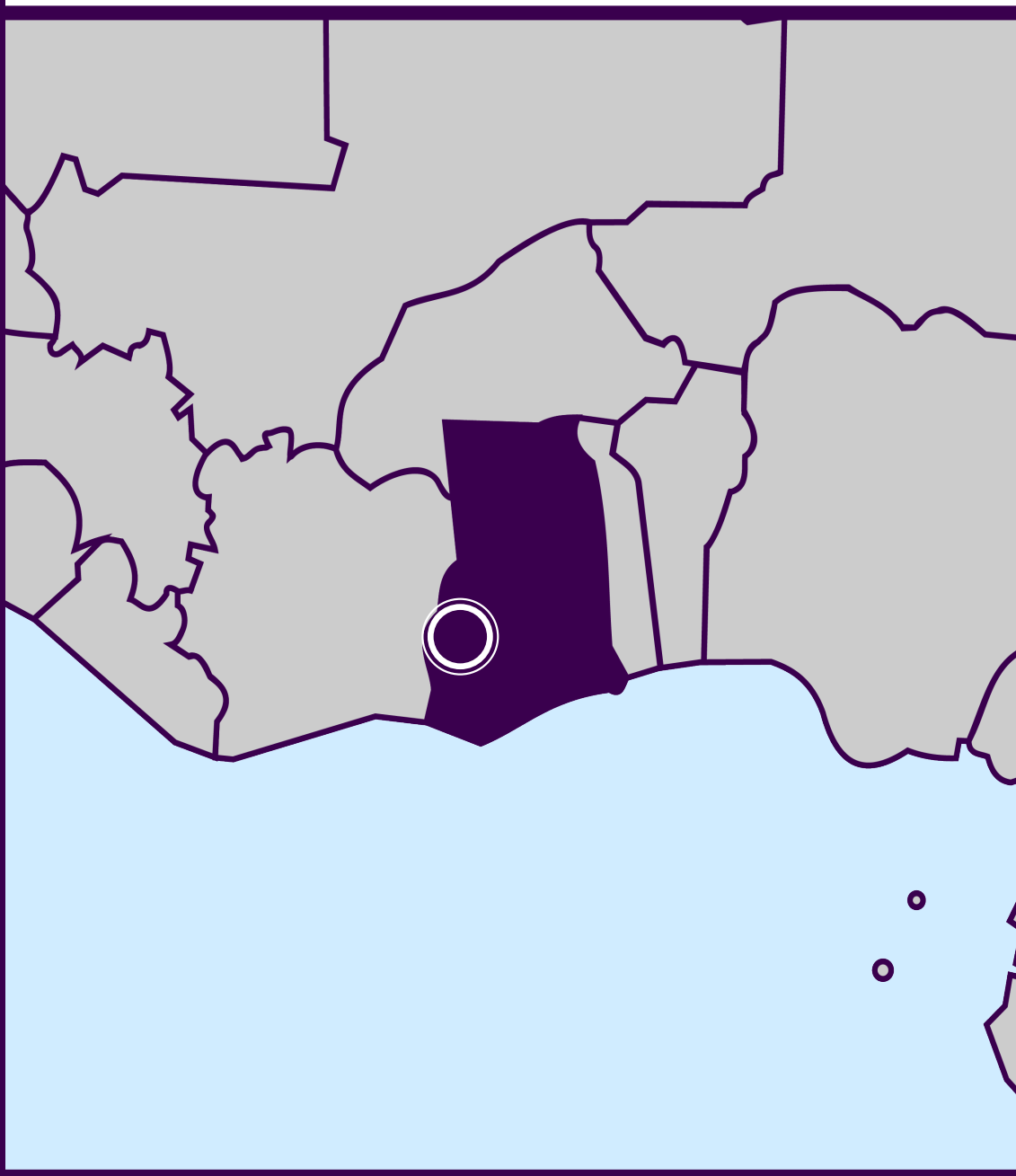
Outbreak of Pertussis at Community A in Dormaa Municipality, Ghana, August 2016

Participant Guide



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Outbreak of Pertussis at Community A in Dormaa Municipality, Ghana, August 2016

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Abstract

Pertussis is a vaccine preventable disease (VPD) monitored by the World Health Organization (WHO). Despite a long-established Pertussis immunization system, the re-emergence of the disease in some countries stressed the need to have well-trained field epidemiologists at the forefront in the fight against these VPDs, especially during an outbreak. Practical, hands-on training is useful for clearer understanding of the principles and development of competencies relevant to outbreak investigation, which will enhance field practice; case method training using realistic public health scenarios helps trainees put into practice learned theory. As such, this case study was adopted from a real Pertussis outbreak investigation that was conducted by Ghana's Field Epidemiology Training Program residents, together with the rapid response team members of Dormaa Municipal health directorate in August 2016. It was primarily designed for training novice public health practitioners in a facilitated classroom setting. Participants should be able to complete the exercises in approximately 3 hours.

How to Use the Case Study

General instructions: Ideally, 1 to 2 instructors facilitate the case study for 8 to 20 students in a classroom or conference room. The instructor should direct participants to read a paragraph out loud, going around the room to give each participant a chance to read. When the participant reads a question, the instructor directs all participants to perform calculations, construct graphs, or engage in discussions. The instructor may split the class to play different roles or take different sides in answering a question. As a result, participants learn from each other, not just from the instructors. Specific instructor's notes are included with each question in the instructor's version of this case study.

Audience: Residents in Frontline Field Epidemiology Training Programs (FETP-Frontline), Field Epidemiology and Laboratory Training Programs (FELTPs), and others who are interested in this topic.

Prerequisites: Before using this case study, case study participants should have received lectures or other instruction in outbreak investigation.

Materials needed: Laptop with Microsoft Excel or graph paper, flipchart or white board with markers

Level of training and associated public health activity: Novice - Outbreak investigation

Time required: Approximately 3 hours

Language: English

Participant Guide

Goal of Case Study – To reinforce knowledge of outbreak investigation of pertussis

Learning Objectives - After completion of this case study, the participants should be able to:

1. Verify the existence of an outbreak and mode of transmission of the disease
2. Describe the process and resources to launch the investigation
3. Develop a working case definition and differentiate between a standard and a working case definition
4. List the steps in taking samples to the laboratory for confirmation
5. Describe the role of the laboratory in disease surveillance and outbreak investigation
6. Describe active case search and develop a line list
7. Construct and interpret an epidemic curve and indicate its values
8. Conduct basic descriptive epidemiological analysis and interpret results
9. Implement control and preventive measures based on findings from the outbreak
10. Identify stakeholders and communicate findings

Introduction

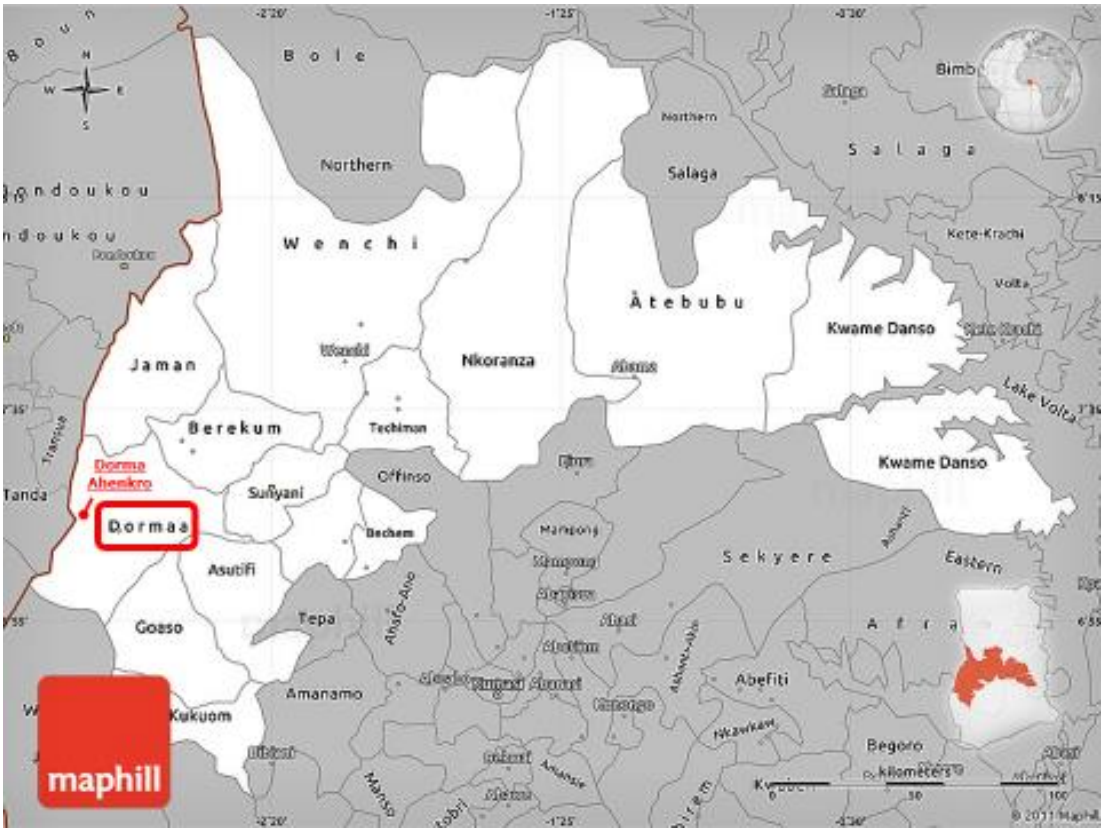
Pertussis, also known as whooping cough, is an extremely contagious disease caused by a *Fastidious gram-negative coccobacillus, Bordetella pertussis* bacterium. The mode of transmission is person-to-person via aerosolized respiratory droplets or by direct contact with respiratory secretions. It is a vaccine preventable disease (VPD) and its vaccines are available and an integral part of the Expanded programme on Immunization (EPI). The incubation period for pertussis is generally between 7-10 days long, but can last more than a month. Initial symptoms may resemble that of a typical cold, including runny nose, sneezing, and a mild cough. A mild fever also generally occurs. Eventually, the patient experiences bouts of rapid coughing followed by the "whooping" sound as they try to inhale. While the coughing fit is occurring, the patient may turn blue**.** [1] [2] [3] [4] [5] According to Ghana's Expanded Programme on Immunization (EPI), vaccination against pertussis is available for children via the combination DPT (diphtheria, pertussis, and tetanus) vaccine. The National EPI Policy recommended three doses of DPT at 6, 10, and 14 weeks of age, and all children born in Ghana are expected to be vaccinated against pertussis [EPI WIKI]. Since the commencement of the EPI program in Ghana, there has been a dramatic decrease in the reported cases of pertussis from 13,509 cases in 1981 to 523 in 2001. Though local outbreaks occur periodically, this usually happens in areas where DPT vaccination coverage is low. The disease is almost extinct and outbreaks have not been reported in decades. Due to the dramatic reduction in the occurrence of the disease, it is no longer a Vaccine Preventable Disease (VPD) surveillance priority. Hence data on pertussis surveillance is limited. [6] [7] [8] [9]The Dormaa Municipality (599 km^2) is one of the 27 administrative districts in the Brong Ahafo Region of Ghana located at the western part of the region (Figure 1). Dormaa Ahenkro, the municipal capital, is located 80 km from Sunyani, the regional capital, and 8 km from the Côte D'Ivoire border According to the 2010 census, the total population of the Municipal for 2016 is 128,500 with a growth rate of 2.5 (Table 1).

Table 1. Distribution of population per target groups, Dormaa Municipal, 2016

Group	Number	Percentage (%)
Women in Reproductive Age	30840	24%
Expected pregnancy	5140	4%
Expected delivery	5140	4%
Children 0-11 months	5140	4%
Children 12-23 months	5140	4%
Children 24 – 59 months	15420	12%

The Municipal Health Directorate has five Sub-Municipalities. Community A is part of a Community-Based Health Planning and Services (CHPS) Zone which is under one of the five sub-Municipalities. The population of Community A is 1040. Children zero to 59 months account for 22% of the population of community A. [10] [11]

Figure 1. Map of Dormaa Municipality, Brong-Ahafo Region in Ghana. [12]



Though no health facility exists in Community A, Child Welfare Clinics (CWCs) in the community are provided by the Gonokrom Community-based Health Planning and Services (CHPS) zone on an outreach basis.[10] The Ghana (CHPS) Initiative is an evidence-based organizational change that strives to scale up innovations in community health care reforms in order to improve the accessibility, efficiency and quality of health and family planning care. [13] [14] [15]. Community-based surveillance volunteers (CBSV) worked within these CHPS zones to conduct community-based surveillance. The community-based surveillance system was established in Ghana as a component of the Integrated Disease Surveillance and Response (IDSR). CBSVs are trained to identify the signs and symptoms of priority diseases and the risk of epidemics as well as other adverse health events which include vaccine preventable diseases in the community. [16] [17] [18]

Part 1

On 02/08/2016, during his household visits, the CBSV in community A identified 15 children who reported a persistent cough lasting longer than Dtwo weeks with at least one of the following signs and symptoms: seizures (i.e., paroxysms), red eyes, inspirational whoop, vomiting, headache, runny nose, sneezing and fever. On 2nd August, 2016, the CBSV reported these cases, suspected to be pertussis, to the municipal disease control office.

The disease control and surveillance officers reported the suspected outbreak to the Municipal Director of health services. Together they collected surveillance data from reporting sites including reports from the designated points of entry. Reviewed and compared data from previous year's surveillance data to ascertain if the cases reported are more than expected and to see if there is the need for investigation. The team retrieved the emergency preparedness plan for the year. Data reviewed did not show any reported case of Pertussis from the reporting facilities in the past decade in community A.

Question 1. Is this an outbreak? Justify your answer.

Question 2. List the steps of outbreak investigation.

They identified the Rapid Response Team members (RRT) and convened a meeting, and took a decision to investigate. Once established, the RRT developed an emergency preparedness plan using the general plan as a guide. The team assigned roles: the training team, the field team the logistic team, the transport team report writing team, the management team. The training team led by the health promoter planned and conducted training and simulation exercise for the staff, planned community information and education activities, alerted nearby facilities and districts about the outbreak, and gave health facilities regular, periodic feedback about routine control and prevention activities. The field team led by the epidemiologist conducted risk mapping, and selected and implemented public health response such as plans to strengthen case management, conduct immunization activities, and improve control and prevention activities. The team convened the public health emergency management committee meeting, and they developed a working case definition. The Municipal Director of Health Services (MDHS) informed the Regional Director of Health Services (RDHS) verbally about the suspected outbreak and instructed the team to produce a notification report to be forwarded to the RDHS. The investigation team sent a notification report to the RDHS and other stakeholders to officially inform them of the suspected outbreak. Upon receipt of the notification, the WHO's Ghana country office supported the regional and municipal biomedical scientists with collection of laboratory specimens for testing.

Question 3. What kind of preparations do you think the investigation team should undertake before heading out to the field? Provide answer in terms of scientific/technical and administrative activities.

Question 4. Who would you include in your outbreak investigation team?

The objective for their investigation was to:

- establish the existence and magnitude of the reported outbreak
- identify the source of the reported outbreak
- implement control measures to prevent further cases, and
- provide recommendations to prevent similar outbreaks in the future.

They retrieved the standard case definition, and identified and gathered the resources needed for the investigation. After assessing the CBSV's report, the investigative team constructed a working case definition. They assigned roles and divided themselves into sub-groups.

Question 5a. Develop a working case definition. (Refer to the narrative in part one above.)
Question 5b. Describe the differences between a suspected, probable, and confirmed case definition classifications with respect to a) the level of certainty, b) sensitivity, and c) specificity.

Question 6. Compare working and standard case definitions

Part 2

The team arrived in the community on the 4th August, 2016. After meeting with the CBSV to obtain an overview of the situation, the team paid a courtesy call to the community chief and elders. Next, they conducted an active case search in the community to identify cases and update the existing line list.

Question 7. Outline the variables that you would include in the headings of the line list.

Table 1. Aggregate line list of pertussis cases according to date of onset during a pertussis outbreak at Community A, 2016

Date of Onset	Cases	Date of Onset	Cases	Date of Onset	Cases
13 Jul 2016	0	23 Jul 2016	1	2 Aug 2016	8
14 Jul 2016	1	24 Jul 2016	1	3 Aug 2016	6
15 Jul 2016	1	25 Jul 2016	1	4 Aug 2016	2
16 Jul 2016	2	26 Jul 2016	5	5 Aug 2016	1
17 Jul 2016	6	27 Jul 2016	9	6 Aug 2016	3
18 Jul 2016	3	28 Jul 2016	14	7 Aug 2016	2
19 Jul 2016	0	29 Jul 2016	5	8 Aug 2016	0
20 Jul 2016	3	30 Jul 2016	4	9 Aug 2016	3
21 Jul 2016	4	31 Jul 2016	1	10 Aug 2016	0
22 Jul 2016	6	1 Aug 2016	10	11 Aug 2016	0

Question 8. Use the information in the line list above to draw an epidemic curve (epi curve). Interpret the curve.

Part 3

On the 4th of August 2016, the investigation team visited the community to assess the situation. They continued active case search in the community. Suspected cases were identified and line listed. Immunization records of the suspected case patients were reviewed.

On the 5th of August 2016, the investigation team continued active case search in the community. More suspected cases were identified and the line list was updated. They conducted an environmental assessment to elicit the environmental factors that triggered the outbreak.

The team led by the MDHS met with the MCE and MCD at the assembly. They were briefed on the outbreak and the steps taken by the MHD to contain the situation. The assembly agreed to support with medicines to treat the suspected cases. They also promised to provide other logistical support.

On Monday 8th August 2016, a team from the Brong Ahafo Regional Health Directorate led by the Deputy Director of Public Health (DDPH) visited the affected district. They were briefed by the investigation team on actions taken so far. Together with the regional team they visited the village.

The team visited the community and administered antibiotics to the affected persons, this activity was led by the medical sub- team. The investigation team aggregated their data for analysis. The team analysed a five-year trend of immunization coverage for the Dormaa Municipal.

Findings: The team after the analysis of data had the following results. A total of 123 suspected cases were recorded. No death was recorded. The attack rate (AR) was 11.83%. None of the cases was hospitalized. None of the cases occurred outside the community. The primary case, a 23-year-old female, occurred on 05/06/2016. The majority of the cases, 87 (70.7%) occurred in July. The modal age was 2 years, accounting for 18.7% of all cases. The median age was 3 years with a range of 0 to 23. Females were most affected 65(52.8%) relative to males. The most affected age group was 0-4 years.

Environmental Findings: The environmental assessment showed that most of the affected families lived in overcrowded and poorly ventilated rooms. We observed that the average size of rooms in the community was 8 x 10 feet with about 3 to 8 persons sleeping in a room. Overcrowding was therefore a major challenge. Also, most of the rooms in the village did not have windows. Some of the rooms which had windows had them sealed with either roofing sheet or plywood. This contributed to poor ventilation.

Question 9. Using the line list provided in Excel, perform a descriptive analysis on the variable AGE and complete the table below.

Summary Statistic	Calculation
Mean	
Median	
Mode	
Range	
Minimum	
Maximum	
Sum	
Count	

Question 10. Using the individual line list provided in Excel, obtain the number of males and females within each age group. Calculate the percentage (out of total) for each age and gender combination.

Age group	Male (%)	Female (%)	Total (%)
0 – 4 years			
5 – 9 years			
10 – 14 years	0	0	0
15 – 19 years			
20+ years	0		
Total			

Part 4

On August 4th, 2016, the clinician suspected a diagnosis of pertussis upon her assessment of some of the cases. Although pertussis can be diagnosed clinically, laboratory identification of *Bordetella pertussis* was required to confirm the disease. Concurrently, the Laboratory investigation team collected samples from each of the suspected cases who had not yet received antibiotics. Samples were tested at the Public Health Reference Laboratory in Ghana and isolated Coccobacilli but did not have the capacity to isolate the specific organism.

Question 11. What type of specimen should be taken in an outbreak of Pertussis?

Question 12. List the steps in taking samples to the laboratory for confirmation

Question 13. Describe the role of the laboratory in outbreak investigation

Question 14. What control and preventive measures should the team put in place during and after the outbreak?

Considering the infectious nature of the organisms that cause pertussis, the team put in place a plan to conduct a reactive immunization in surrounding communities. The team also considered the fact that movement from community to community is swift in these modern times. Hence travelers in and out of

community A could spread the disease. An immunization team was formed, sensitized and given the task to carry out a reactive immunization.

Question 15. If you were the leader of the team, what would you include in a reactive immunization plan?

Question 16. List the four types of reports in an outbreak investigation and mention the parts of a report you would include in the outbreak report write up.

Question 17. What are some feasible recommendations you can make based on your findings?

Question 18. Identify stakeholders to communicate your findings to.

Question 19. What modes of communication with stakeholders would you use in this case?

Question 20. List steps you would use to monitor and evaluate the implementation of your recommendations.

Conclusion

Possible contributing factors to the spread of pertussis in the Dormaa municipality were low immunization coverage and poor environmental practices at the community level. Identification and treatment of cases helped to stop the spread of infection. Mop-up pentavalent vaccination was conducted to help improve the herd immunity in the community and its surrounding villages.

Pertussis is a major cause of childhood morbidity and mortality. It remains one of the world's leading causes of vaccine-preventable deaths. An estimated 50 million cases and 300 000 deaths occur every year. There is evidence of a high burden of pertussis in developing countries where case-fatality rates are estimated to be as high as 4% in infants. [27] Pertussis is endemic worldwide, with peaks occurring every 2-5 years. It is highly infectious, with secondary attack rates of 70-100% among unimmunized contacts. [3]

The World Health Organization (WHO) initiated the Expanded Programme on Immunization (EPI) in May 1974 with the objective to vaccinate children throughout the world. High immunization coverage with an effective vaccine is the mainstay of prevention. The rationale for pertussis surveillance is to monitor the impact of the immunization system, identify high-risk areas and detect outbreaks (which must then be investigated). An effective surveillance system for pertussis is necessary to monitor and detect any outbreaks early for rapid response. [9] [7]

Background Readings

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Competing Interests

The authors declare no competing interest.

Author's Contributions

Edwin Andrew Afari: Reviewed the manuscript for intellectual content and also revised the outbreak report write-up and made important intellectual contribution. **Samuel Dapaah:** Developed protocols for the investigation, data collection and analysis, follow-up of study participants, collection of specimens for laboratory analysis, supervised field workers, acquisition of data. **Daniel Owusu-amponsah:** Data collection and analysis, follow-up of study participants, support the collection of specimen for laboratory analysis, supervised field workers, acquisition of data and report write-up. **Joseph Asamoah Frimpong:** Helped with the design, data analysis, revised the manuscript and made critical intellectual contribution to the content of the manuscript. **Meeyoung Mattie Park:** Supervised the entire write-up of the manuscript, worked on the design, analysis, and final write-up of the manuscript. **Ernest Kenu:** Helped in

the analysis and interpretation of data, made input into the outbreak report write-up. **Scott JN McNabb:** Conceptualized the case study design, reviewed the manuscript and approved this version to be published. **Ernest Konadu Asiedu**: Revised the manuscript and made critical intellectual contribution to the content of the manuscript and assisted in data analysis.

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